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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte WILLIAM EARL RUSSELL II,
DAVID JOSEPH KROPACZEK and GLEN ALAN WATFORD

Appeal 2008-4642
Application 10/608,086
Technology Center 3600

Decided: February 12, 2009[1]

Before WILLIAM F. PATE, III, JENNIFER D. BAHR, and
JOHN C. KERINS, *Administrative Patent Judges*.

KERINS, *Administrative Patent Judge*.

DECISION ON APPEAL

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[1] The two month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, begins to run from the decided date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery).

STATEMENT OF THE CASE

William Earl Russell II et al. (Appellants) seek our review under 35 U.S.C. § 134 of the Examiner's final rejection of claims 31-41, the only claims now pending in the application. We have jurisdiction under 35 U.S.C. § 6(b) (2002).

SUMMARY OF DECISION

We REVERSE.

THE INVENTION

Appellants' claimed invention is to a method for determining independent control variable values in an operating nuclear reactor, in which state-point data is received and an "optimization process" is performed using that data to generate "one or more independent control variable values". (Appeal Br., Claims Appendix, claim 31).

Claim 31, reproduced below, is representative of the subject matter on appeal.

> 31. A method of determining independent control variable values for a nuclear reactor under operation, comprising:
>
> receiving state-point data for the operating nuclear reactor, the state-point data including current values for independent control variables and for dependent performance variables of the operating nuclear reactor; and

> performing an optimization process on one of a computer and computer network based on the received state-point data to generate one or more independent control variable values.

THE REJECTION

The Examiner relies upon the following as evidence of unpatentability:

Musick	US 4,080,251	Mar. 21, 1978
Takeuchi	US 5,009,833	Apr. 3, 1991

Pryor, Jr., "The Economics of Nuclear Energy", *Nuclear Plant Journal* Editorial Archive, October 30, 1998.

Dozier, et al., "Winning Strategies for Maintenance Optimization at U.S. NPPs", *Nuclear Plant Journal* Editorial Archive, March 3, 2000.

Knollenberg, "The Energy Supply for the United States & the Role of Nuclear Energy", transcript of speech delivered at the University of Michigan, April 20, 2000 (accessed February 7, 2007 at http://www.house.gov/knollenberg/mediacenter/speeches/2000/04.20.00.htm).

The Examiner has rejected claims 31-39 under 35 U.S.C. § 103(a) as being unpatentable over Musick in view of any of Pryor, Dozier, and Knollenberg. The Examiner has rejected claims 40 and 41 under 35 U.S.C. § 103(a) as being unpatentable over Musick in view of Pryor, Dozier, and Knollenberg, and further in view of Takeuchi.

ISSUE

The Examiner concluded that the combined teachings of Musick, Pryor, Dozier and Knollenberg renders unpatentable a method of determining independent control variables values that includes performing

an optimization process based on received state-point data to generate one or more such values for independent control variables.

Appellants urge that the combination of references does not teach or suggest (1) an optimization process; (2) [an optimization process] based on received state-point data; and (3) [an optimization process] to generate one or more independent control variable values.

The issue joined in this appeal is: have Appellants demonstrated that the Examiner erred in reaching the conclusion that the claims are unpatentable?

FINDINGS OF FACT

The following enumerated findings of fact (FF) are supported by at least a preponderance of the evidence. *Ethicon, Inc. v. Quigg*, 849 F.2d 1422, 1427 (Fed. Cir. 1988) (explaining the general evidentiary standard for proceedings before the Office).

FF 1. Dozier discloses maintenance strategies that have the goal of increasing reliability and plant availability while reducing costs. (Dozier, p. 1, section titled "Purpose").

FF 2. Pryor discloses that plant efficiencies, as gauged by plant operating capacity factors, may be optimized by avoiding forced plant outages and optimizing maintenance operations. (Pryor, p. 2, section titled "The Nuclear Industry Today").

FF 3. Appellants identify that their optimization process is desirably conducted to bring about, "improved fuel cycle efficiency, better global reactor economics and enhanced operational efficiency". (Specification, ¶[0010]).

FF 4. Claim 31 contains no element or limitation that specifies what aspect or aspects of the operation of the nuclear reactor are to be optimized in performing the claimed optimization process. (Appeal Br., Claims Appendix, claim 31).

FF 5. Musick discloses, at columns 13 and 15, parameters that are to be used as inputs to the Musick control process. (Musick, col. 13, ll. 11-37; col. 15, l. 29-col. 16, l. 13).

FF 6. Musick discloses that a calculated/generated operating limit can be "register[ed] … on a visual indicator 170 which would allow the reactor operator to compare the actual reactor operating condition to the [Core Operating Limit Supervisory System, or COLSS] limit. With this knowledge available to the operator, he will be able to operate the reactor in such a way that sufficient margin is continuously maintained while at the same time maximizing the capability and availability of the reactor." (Musick, col. 12, ll. 8-23).

FF 7. Musick further states that the plant power could automatically be restricted to be within the COLSS limit, without stating how this would be done. (Musick, col. 12, ll. 23-26).

FF 8. Musick describes that a limit (false limit, because a safety margin is built in) is displayed to the operator to inform him that if that limit were to be exceeded, the DNBR [Departure from Nucleate Boiling Ratio] margin would be less than required. Musick further discloses that the operator has two choices if the margin is encroached upon: (1) insert control rods to decrease actual reactor power; or (2) vary one of the other parameters on which the DNBR is dependent, such as coolant pressure or coolant mass

flow rate, to raise the computed power limit (increasing the DNBR margin). (Musick, col. 20, ll. 1-68).

PRINCIPLES OF LAW

"Section 103 forbids issuance of a patent when 'the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.'" *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, ___, 127 S. Ct. 1727, 1734 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). *See also KSR*, 550 U.S. 398 at ___, 127 S. Ct. at 1734 ("While the sequence of these questions might be reordered in any particular case, the [*Graham*] factors continue to define the inquiry that controls.").

ANALYSIS

Appellants argue all of claims 31-39 as a first group, and argue separately claims 40 and 41 as a second group. Claims 31 and 40 will be regarded as the representative claims of these two groups.

The claims in their current form were the subject of a previous appeal, No. 2006-1486. In that proceeding, rejections made by the Examiner under 35 U.S.C. § 102(b) in view of Takeuchi and, separately, in view of Musick, and under 35 U.S.C. § 103(a) over Musick in view of Takeuchi, were

reversed. The application was remanded to the Examiner, "to determine whether prior art is available that discloses, or would have fairly suggested, to one of ordinary skill in the art, performing a computerized optimization process of a nuclear reactor to generate, from received state-point data, one or more independent control variable values." (Decision on Appeal dated May 24, 2006, p. 5)(hereafter, "Prior Decision").

Claims 31-39

Appellants contend that the cited prior art fails to teach (1) an optimization process; (2) [an optimization process] based on received state-point data; and (3) [an optimization process] to generate one or more independent control variable values. (Appeal Br. 14).

The Examiner relies on Musick as disclosing a computerized control method for a nuclear plant that maximizes plant capacity and availability within acceptable fuel design limits. (Answer 5). The Examiner relies on any of Dozier, Knollenberg, or Pryor as evidencing that persons of ordinary skill in the art would appreciate that nuclear plant control methods which seek to increase reliability, plant availability, and/or plant capacity would be considered to be optimization processes, and thus the Musick control method performs an optimization process. (Answer 6-7).

The additional references (Dozier, Knollenberg, Pryor) do, as asserted by the Examiner, establish that the control system disclosed in Musick operates to achieve what persons of ordinary skill in the art would consider an "optimization" of plant operations. For example, Dozier discloses maintenance strategies that have the goal of increasing reliability and plant availability while reducing costs. (FF 1). As but another example, Pryor

discloses that plant efficiencies, as gauged by plant operating capacity factors, may be optimized by avoiding forced plant outages and optimizing maintenance operations. (FF 2). Indeed, Appellants' Specification identifies that their optimization process is desirably conducted to bring about, "improved fuel cycle efficiency, better global reactor economics and enhanced operational efficiency". (FF 3). Appellants additionally acknowledge that these references teach that optimization may include maximized plant availability and capacity within particular design limits. (Reply Br. 5).

Appellants contend that the Musick process involves using modified plant parameters to generate operating limits for safe operation and termination. (Appeal Br. 11). Appellants urge that is wholly distinct from a general optimization process that is based on state-point data or generates an independent control variable, and contend that the Board, in its prior decision, agreed that this was a distinguishing feature.[2] (*Id.*). Appellants further characterize the Musick system as one for monitoring a safe shutdown process based on modified operational data to generate a design limit. (Appeal Br. 14).

Claim 31 contains no element or limitation that specifies what aspect or aspects of the operation of the nuclear reactor are to be optimized in performing the claimed optimization process. (FF 4). A process that generates a safe operating limit or a design limit for the nuclear reactor, and that conveys information pertaining thereto for use by an operator of the

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[2] In reversing the then-extant anticipation rejection, the Board found that, "Musick determines the design limits … . The examiner has not established that Musick discloses, or would have fairly suggested, … , determining the optimum within those limits." (Prior Decision 4).

nuclear reactor, to thereby allow the reactor to be operated more safely and efficiently, within design limits, constitutes an optimization process, as broadly claimed.

The Examiner found, and Appellants acknowledge, that the Musick control process includes a step of receiving state-point data including at least one current value for an independent control variable, namely a reactor coolant flow rate, and including values of dependent control variables. (Answer 2, 10; Appeal Br. 13). As such, we are not persuaded by Appellants' contention (see (2) above) that the prior art does not teach performing an optimization process that is based on received state-point data.

Appellants finally contend that the Musick control process fails to generate one or more independent control variable values, a further element present in claim 31. (Appeal Br. 13; Reply Br. 4-6).

The Examiner contends that Musick involves, "maximization of plant capacity and availability within design limits [that] optimizes ONLY selected parameters (which includes independent control variables) and NOT all parameters, because changing one parameter inherently causes change in some other parameters", and that this meets the claim limitation requiring the generation of at least one independent control variable. (Answer 5, 9)(emphasis in original). The Examiner additionally asserts that, "maximization of plant capacity and availability INHERENTLY includes optimization of at least one independent control variable, as confirmed by the teaching in any of Dozier, Knollenberg, or Pryor, Jr." (Answer 10)(emphasis in original). Finally, the Examiner asserts that passages found in Musick at column 13, lines 22+, and at column 15, lines 35+, establish

that the Musick process generates one or more independent control variables from received state-point data. (Answer 7, citing to "Background" section at Answer 2).

With respect to this last contention, the Examiner's reliance on the passages cited from columns 13 and 15 of the Musick patent as teaching the generation, by an optimization process, of one or more independent control variables is misplaced. Musick, in those passages, discloses parameters that are to be used as inputs to the Musick control process. (FF 5). Nowhere in those passages is it disclosed that an output of the control process is the generation of an independent control variable.

The Examiner's assertions that this claim element is an inherent result of the Musick control process are also misplaced. Musick, at one place, states that a calculated/generated operating limit can be "register[ed] … on a visual indicator 170 which would allow the reactor operator to compare the actual reactor operating condition to the [Core Operating Limit Supervisory System, or COLSS] limit. With this knowledge available to the operator, he will be able to operate the reactor in such a way that sufficient margin is continuously maintained while at the same time maximizing the capability and availability of the reactor." (FF 6). Alternatively, Musick states that the plant power would automatically be restricted to be within the COLSS limit (FF 7), without stating how this would be done.

In a somewhat more detailed discussion of the COLSS, Musick describes that a limit (false limit, because a safety margin is built in) is displayed to the operator to inform him that if that limit were to be exceeded, the DNBR [Departure from Nucleate Boiling Ratio] margin would be less than required. (FF 8). The operator is said to have two choices if the margin

is encroached upon: (1) insert control rods to decrease actual reactor power; or (2) vary one of the other parameters on which the DNBR is dependent, such as coolant pressure or coolant mass flow rate, to raise the computed power limit (increasing the DNBR margin). (*Id.*).

None of this detailed discussion points to the generation of an independent control variable value by the Musick control process. The COLSS limit and the DNBR, which are two values generated by the process, have not been established by the Examiner to be independent control variables. To the contrary, Musick appears to evidence that these values are dependent performance variables of the operating nuclear reactor.

We are further not persuaded that any of the Musick, Dozier, Knollenberg, or Pryor, Jr., references evidence that values for one or more independent control variables are inherently generated in a nuclear reactor optimization process. The Musick control scheme appears to leave it to a human operator to determine, based solely on providing overall operational limits (COLSS limit, DMBR), whether or not to change any of the independently controllable variables. (*Id.*). The alternative control scheme, as disclosed, is to automatically restrict the plant power to be within the COLSS limit if a particular limit is approached. (FF 7). Neither of these control schemes appears to contemplate the generation of values for any independent control variables. The Examiner has not identified any specific portions of the other references that tend to establish that values for independent control variables are necessarily generated in performing a reactor optimization process.

Appellants have thus established that the combined teachings of Musick, Dozier, Knollenberg, and Pryor, Jr., do not disclose or suggest a

method for determining independent control variable values that includes performing an optimization process that generates one or more of such independent control variable values. The rejection of claims 31-39 will not be sustained.

Claims 40-41

Claims 40 and 41 depend from claim 31. The claims are rejected as being unpatentable over the teachings of the references applied to claim 31, and further in view of Takeuchi. The Examiner does not identify any part of the cited Takeuchi reference that appears to overcome the deficiency discussed above with respect to claim 31 and the other cited references. Additionally, we do not find any disclosure in Takeuchi of performing an optimization process that generates values of one or more independent control variables.

Appellants have persuaded us that error was committed in the rejection of claim 40 and 41 under 35 U.S.C. § 103(a) over Musick in view of Pryor, Dozier, or Knollenberg, and further in view of Takeuchi. The rejection of claims 40 and 41 will not be sustained.

CONCLUSION

Appellants have established that reversible error exists in the rejection of claims 31-41 under 35 U.S.C. § 103(a).

ORDER

The decision of the Examiner to reject claims 31-41 is:

REVERSED

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